

SILICON GATE CMOS

131,072 WORD x 8 BIT STATIC RAM

Description

The TC551001API is a 1,048,576 bit CMOS static random access memory organized as 131,072 words by 8 bits and operated from a single 5V power supply. Advanced circuit techniques provide both high speed and low power features with an operating current of 5mA/MHz (typ.) and a minimum cycle time of 85ns. When $\overline{CE1}$ is a logical high, or CE2 is low, the device is placed in a low power standby mode in which the standby current is 2 μ A typically. The TC551001API has three control inputs. Chip enable inputs ($\overline{CE1}$, CE2) allow for device selection and data retention control, while an output enable input (\overline{OE}) provides fast memory access. The TC551001API is suitable for use in microprocessor systems where high speed, low power, and battery backup are required. The TC551001API has an operating temperature range of -40 ~ 85°C so it is suitable for use in wide operating temperature systems.

The TC551001API is offered in a standard dual-in-line 32-pin plastic package, a small outline plastic package, and a thin small outline plastic package (forward type, reverse type).

Features

- Low power dissipation: 27.5mW/MHz (typ.)
- Standby current: 200 μ A (max.)
- Single 5V power supply
- Access time (max.)

	TC551001API/AFI/AFTI/ATRI	
	-85	-10
Access Time	85ns	100ns
$\overline{CE1}$ Access Time	85ns	100ns
CE2 Access Time	85ns	100ns
\overline{OE} Access Time	45ns	50ns

- Power down feature: $\overline{CE1}$, CE2
- Data retention supply voltage: 2.0 ~ 5.5V
- Inputs and outputs TTL compatible
- Wide operating temperature: -40 ~ 85°C
- Package
 - TC551001API : DIP32-P-600
 - TC551001AFI : SOP32-P-525
 - TC551001AFTI : TSOP32-P-0820
 - TC551001ATRI : TSOP32-P-0820A

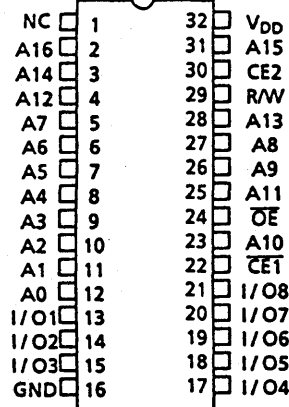
Pin Names

A0 ~ A16	Address Inputs
R/W	Read/Write Control Input
\overline{OE}	Output Enable Input
$\overline{CE1}$, CE2	Chip Enable Inputs
I/O1 ~ I/O8	Data Input/Output
V _{DD}	Power (+5V)
GND	Ground
NC	No Connection

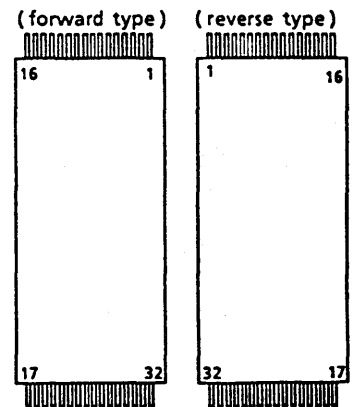
PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PIN NAME	A ₁₁	A ₉	A ₈	A ₁₃	R/W	CE2	A ₁₅	V _{DD}	NC	A ₁₆	A ₁₄	A ₁₂	A ₇	A ₆	A ₅	A ₄
PIN NO.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
PIN NAME	A ₃	A ₂	A ₁	A ₀	I/O1	I/O2	I/O3	GND	I/O4	I/O5	I/O6	I/O7	I/O8	$\overline{CE1}$	A ₁₀	\overline{OE}

Pin Connection (Top View)

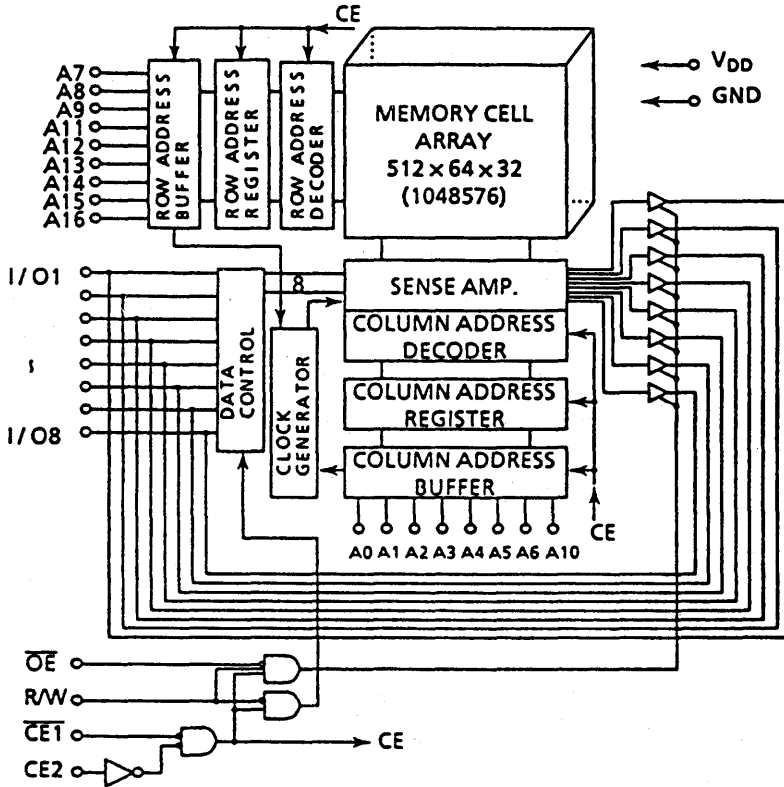
o 32 PIN DIP & SOP



o 32 PIN TSOP



Block Diagram



Operating Mode

MODE	PIN	$\overline{CE1}$	CE2	\overline{OE}	R/W	I/O1 - I/O8	POWER
Read		L	H	L	H	D _{OUT}	I _{DDO}
Write		L	H	*	L	D _{IN}	I _{DDO}
Output Deselect		L	H	H	H	High-Z	I _{DDO}
Standby		H	*	*	*	High-Z	I _{DDS}
		*	L	*	*	High-Z	I _{DDS}

* H or L

Maximum Ratings

SYMBOL	ITEM	RATING	UNIT
V _{DD}	Power Supply Voltage	-0.3 ~ 7.0	V
V _{IN}	Input Voltage	-0.3* ~ 7.0	V
V _{I/O}	Input and Output Voltage	-0.5 ~ V _{DD} + 0.5	V
P _D	Power Dissipation	1.0/0.6**	W
T _{SOLDER}	Soldering Temperature • Time	260 • 10	°C • sec
T _{STRG}	Storage Temperature	-55 ~ 150	°C
T _{OPR}	Operating Temperature	-40 ~ 85	°C

* -3.0V with a pulse width of 50ns

** SOP

DC Recommended Operating Conditions

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{DD}	Power Supply Voltage	4.5	5.0	5.5	V
V_{IH}	Input High Voltage	2.4	-	$V_{DD} + 0.3$	
V_{IL}	Input Low Voltage	-0.3	-	0.6	
V_{DH}	Data Retention Supply Voltage	2.0	-	5.5	

DC Characteristics ($T_a = -40 \sim 85^\circ\text{C}$, $V_{DD} = 5V \pm 10\%$)

SYMBOL	PARAMETER	TEST CONDITION	MIN.	TYP.	MAX.	UNIT		
I_{LI}	Input Leakage Current	$V_{IN} = 0 \sim V_{DD}$	-	-	± 1.0	μA		
I_{LO}	Output Leakage Current	$\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$ or $R/W = V_{IL}$ or $\overline{OE} = V_{IH}$, $V_{OUT} = 0 \sim V_{DD}$	-	-	± 1.0	μA		
I_{OH}	Output High Current	$V_{OH} = 2.4V$	-1.0	-	-	mA		
I_{OL}	Output Low Current	$V_{OL} = 0.4V$	4.0	-	-	mA		
I_{DDO1}	Operating Current	$\overline{CE1} = V_{IL}$ and $CE2 = V_{IH}$ and $R/W = V_{IH}$, $I_{OUT} = 0\text{mA}$ Other Inputs = V_{IH}/V_{IL}	t_{cycle}	Min.	-	-	70	mA
				$1\mu\text{s}$	-	-	20	
I_{DDO2}		$\overline{CE1} = 0.2V$ and $CE2 = V_{DD} - 0.2V$ $R/W = V_{DD} - 0.2V$ $I_{OUT} = 0\text{mA}$ Other Inputs $= V_{DD} - 0.2V/0.2V$	t_{cycle}	Min.	-	-	60	
				$1\mu\text{s}$	-	-	10	
I_{DSS1}	Standby Current	$\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$		-	-	3	mA	
$I_{DSS2}^{(1)}$		$\overline{CE1} = V_{DD} - 0.2V$ or $CE2 = 0.2V$ $V_{DD} = 2.0V \sim 5.5V$	$T_a = -40 \sim 85^\circ\text{C}$	-	-	200	μA	
		$T_a = 25^\circ\text{C}$	-	2	-			

Note (1): If $\overline{CE1} \geq V_{DD} - 0.2V$, the specified limits are guaranteed under the condition $CE2 \geq V_{DD} - 0.2V$ or $CE2 \leq 0.2V$.

Capacitance* ($T_a = 25^\circ\text{C}$, $f = 1\text{MHz}$)

SYMBOL	PARAMETER	TEST CONDITION	MAX.	UNIT
C_{IN}	Input Capacitance	$V_{IN} = \text{GND}$	10	pF
C_{OUT}	Output Capacitance	$V_{OUT} = \text{GND}$	10	

*This parameter is periodically sampled and is not 100% tested.

AC Characteristics (Ta = -40 ~ 85°C, V_{DD} = 5V±10%)

Read Cycle

SYMBOL	PARAMETER	TC551001API/AFI/AFTI/ATRI				UNIT
		-85		-10		
		MIN.	MAX.	MIN.	MAX.	
t _{RC}	Read Cycle Time	85	–	100	–	ns
t _{ACC}	Address Access Time	–	85	–	100	
t _{CO1}	$\overline{CE1}$ Access Time	–	85	–	100	
t _{CO2}	CE2 Access Time	–	85	–	100	
t _{OE}	Output Enable to Output in Valid	–	45	–	50	
t _{COE}	Chip Enable ($\overline{CE1}$, CE2) to Output in Low-Z	5	–	5	–	
t _{OEE}	Output Enable to Output in Low-Z	0	–	0	–	
t _{OD}	Chip Enable ($\overline{CE1}$, CE2) to Output in High-Z	–	35	–	40	
t _{ODO}	Output Enable to Output in High-Z	–	35	–	40	
t _{OH}	Output Data Hold Time	10	–	10	–	

Write Cycle

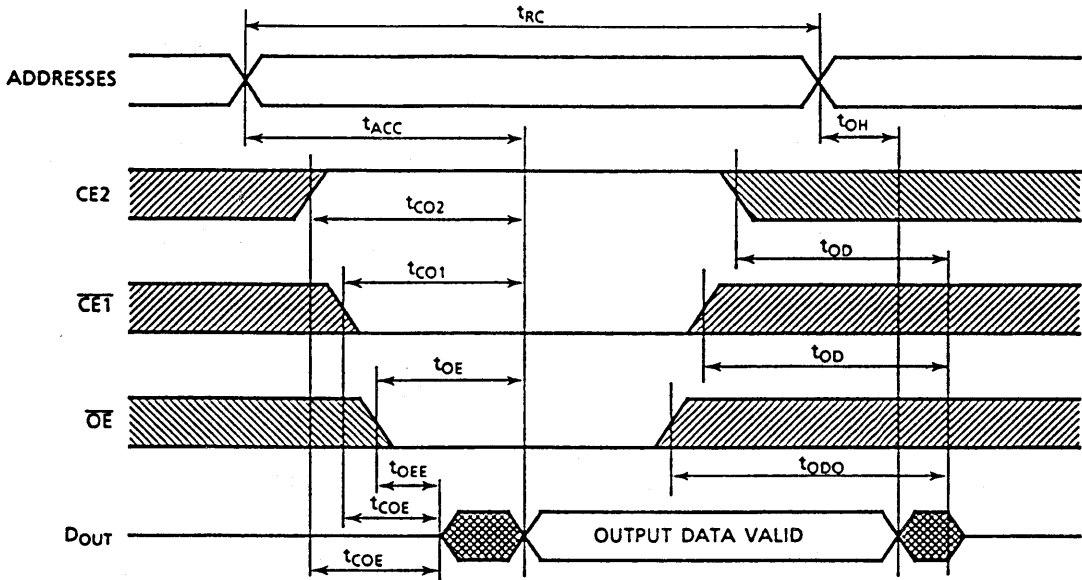
SYMBOL	PARAMETER	TC551001API/AFI/AFTI/ATRI				UNIT
		-85		-10		
		MIN.	MAX.	MIN.	MAX.	
t _{WC}	Write Cycle Time	85	–	100	–	ns
t _{WP}	Write Pulse Width	60	–	60	–	
t _{CW}	Chip Selection to End of Write	75	–	80	–	
t _{AS}	Address Setup Time	0	–	0	–	
t _{WR}	Write Recovery Time	0	–	0	–	
t _{ODW}	R/W to Output in High-Z	–	35	–	40	
t _{OEW}	R/W to Output in Low-Z	0	–	0	–	
t _{DS}	Data Setup Time	35	–	40	–	
t _{DH}	Data Hold Time	0	–	0	–	

AC Test Conditions

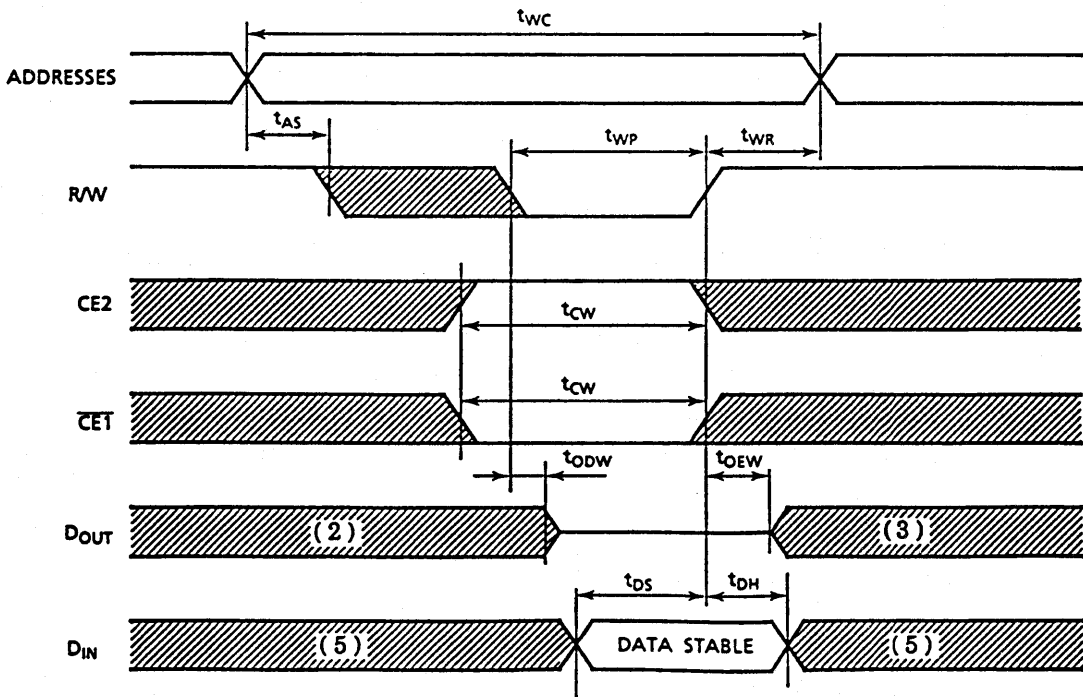
Input Pulse Levels	2.6V/0.4V
Input Pulse Rise and Fall Time	5ns
Input Timing Measurement Reference Levels	1.5V
Output Timing Measurement Reference Levels	1.5V
Output Load	1 TTL Gate and C _L = 100pF

Timing Waveforms

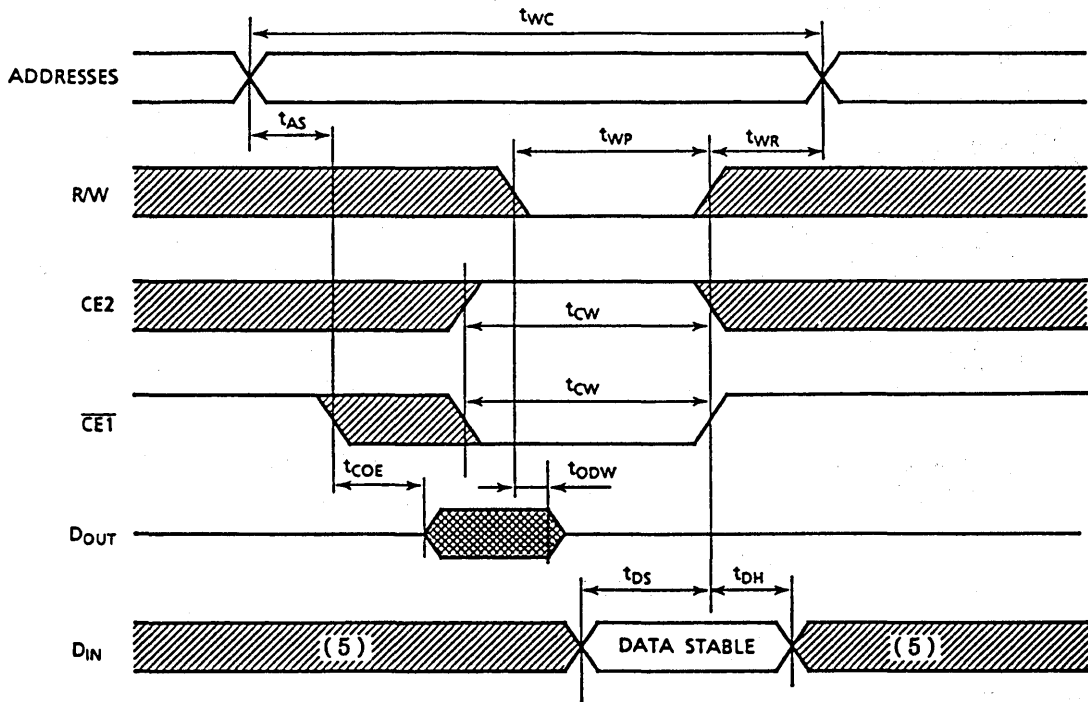
Read Cycle ⁽¹⁾



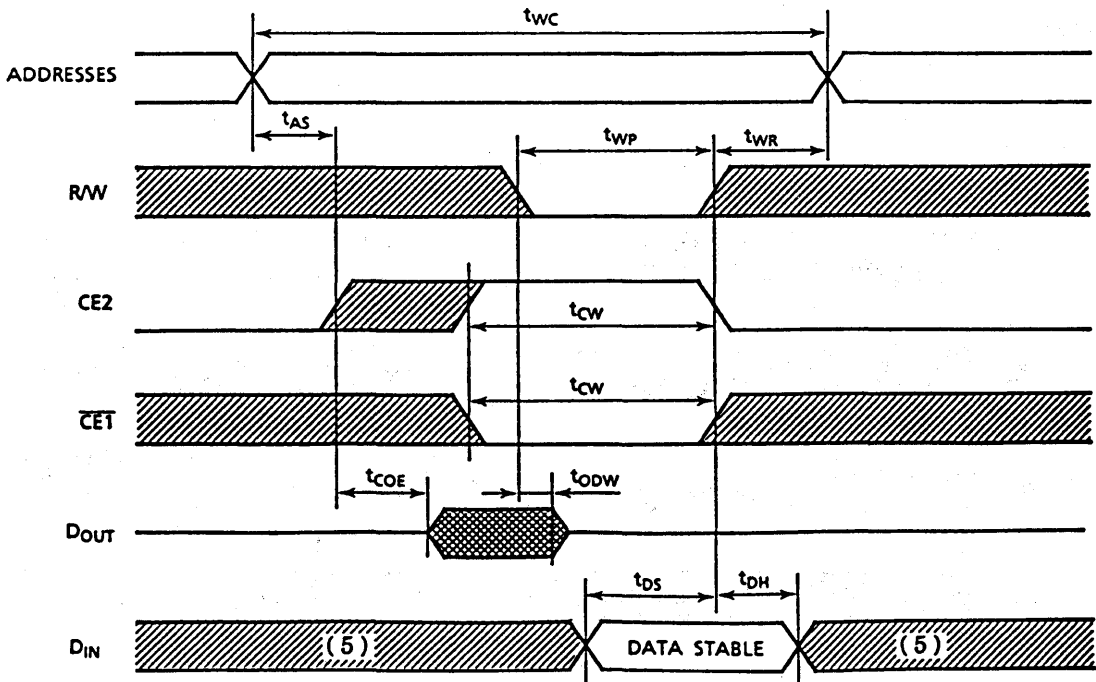
Write Cycle 1 ⁽⁴⁾ (R/W Controlled Write)



Write Cycle 2 ⁽⁴⁾ ($\overline{CE1}$ Controlled Write)



Write Cycle 3 ⁽⁴⁾ ($CE2$ Controlled Write)



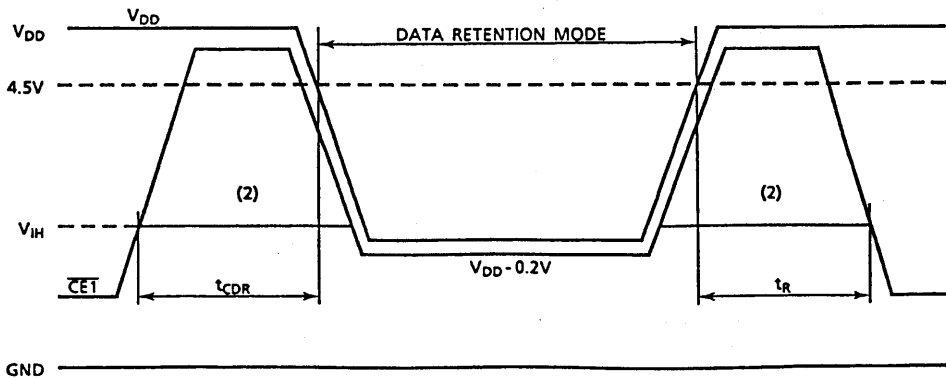
Notes:

1. R/W is high for read cycles.
2. If the $\overline{\text{CE1}}$ low transition or CE2 high transition occurs coincident with or after the R/W low transition, outputs remain in a high impedance state.
3. If the $\overline{\text{CE1}}$ high transition or CE2 low transition occurs coincident with or prior to the R/W high transition, outputs remain in a high impedance state.
4. If $\overline{\text{OE}}$ is high during a write cycle, the outputs are in a high impedance state during this period.
5. The I/O may be in the output state during this time; therefore input signals of opposite phase must not be applied.

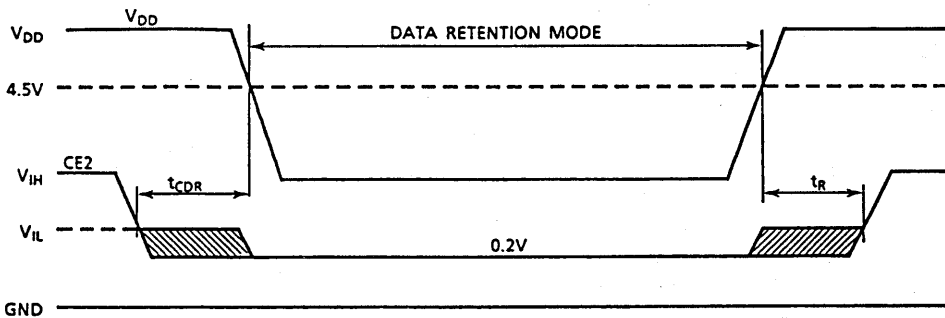
Data Retention Characteristics (Ta = -40 ~ 85°C)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V _{DH}	Data Retention Supply Voltage	2.0	—	5.5	V
I _{DD} S2	Standby Current	V _{DH} = 3.0V	—	100	μA
		V _{DH} = 5.5V	—	200	
t _{CDR}	Chip Deselect to Data Retention Mode	0	—	—	ns
t _R	Recovery Time	5	—	—	ms

$\overline{CE1}$ Controlled Data Retention Mode (1)



CE2 Controlled Data Retention Mode (3)



Notes:

1. In the $\overline{CE1}$ controlled data retention mode, minimum standby current is achieved under the condition $CE2 \leq 0.2V$ or $CE2 \geq V_{DD} - 0.2V$.
2. If the V_{IH} of $\overline{CE1}$ is 2.4V in operation, during the period that the V_{DD} voltage is going down from 4.5V to 2.6V, $I_{DD}S1$ current flows.
3. In the CE2 controlled data retention mode, minimum standby current is achieved under the condition $CE2 \leq 0.2V$.